Contribution ID: **64** Type: **not specified**

Modelling Magnetic Field Growth in Disc Galaxies within the Framework of $\alpha - \Omega$ Dynamo Theory

Saturday, 21 January 2023 16:30 (1h 30m)

The origin of magnetic fields in the universe and the role of individual galaxies in it is still an open question in modern cosmology. Observational data such as the polarization and intensity of total radio synchrotron emission have historically allowed for a better study of the strength and the shape of the magnetic fields in galaxies. More recently, cosmological simulations of magnetic fields in disk galaxies using magnetohydrodynamics equations provided insight into how magnetic fields in a galaxy have grown throughout time. Here, we use one of the preferred theories for field evolution, $\alpha - \Omega$ galactic dynamo theory, based on the idea that magnetic fields of most galaxies are sustained by dynamos, mechanisms that convert ordered and turbulent plasma flow into magnetic energy to investigate factors that can realistically create and amplify the magnetic field values seen in modern astronomical observations. We utilize the Adaptive Mesh Refinement solver RAMSES developed by Teyssier (2002) in order to explore factors that distort or amplify the magnetic field lines within a galaxy. We further simulate the $\alpha - \Omega$ galactic dynamo through the subgrid turbulent dynamo model developed by Liu et. al. (2022). It was found that for seed magnetic fields with strengths 1E−10 G, $\alpha - \Omega$ dynamo is successful in generating the magnetic field strength values we observe in galaxies today. It was also found that magnetic field evolution is influenced by a combination of internal processes that make up the simulation (i.e. subgrid turbulent dynamo) and the initial conditions, namely, the initial field topology, uniformity, and the magnetic field strength.

Presenter: KARAASLAN, Inci (Princeton University)

Session Classification: Poster Session + Grad/Career Fair